A Review of the Genus *Loricella* (Order Polyplacophora), with Notes on Features Previously Unnoted and Description of a New Species.

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Plate X.

The only recorded species of the genus *Loricella* was described by H. Adams and Angas in P.Z.S., 1864, p. 193, under the name of *Lorica angasi*, but later Pilsbry, in Man. Con., pt. 56, p. 238, very wisely separates it from that genus, and proposes the generic name of *Loricella* for its reception, distinguishing it from the genus *Lorica* as follows: "Sinus in tail valve a mere wave; jugal sinus lobed; girdle widest in front, not cleft behind"; but adds the note, "I have not seen this species, which is here figured for the first time from drawings made by Emerton for Carpenter."

An examination of a fair series makes it necessary to modify this generic description. The sinus in the tail valve in most specimens is considerably more than "a mere wave," although certainly not as deep as in the genus *Lorica*, and Dr. Pilsbry is quite in error in stating that the girdle "is not cleft behind," for in all my specimens from New South Wales, Victoria, Tasmania, and South Australia the girdle is very distinctly cleft, though only for half the width of the girdle. The cleft in the girdle probably did not show clearly in the dried specimens that Carpenter was dealing with, and this fact somewhat misled Pilsbry. This cleft and the character of the tail valve show some affinity with the genus *Lorica*, but on the other hand the large head and small foot, together with its markedly distinct girdle suggest that this relationship may be more seeming than real.

I therefore propose that instead of treating it as a section or subgenus of *Lorica*, as is done by Dr. Pilsbry (Man. Con., pt. 56, p. 233), it should be elevated to full generic rank.

As Adams and Angas' type of *Loricella angasi* came from Rapid Bay, South Australia, that name will have to be retained for the South Australian species. It is remarkable that in the original description no mention is made of the row of long, branching, coarse hairs, or of the strange spear-headed spicules attached to them, which are a prominent feature on the girdle of the South Australian form, and which is described herein for the first time. The only explanation is that the type was a worn specimen that had been washed ashore.

Dr. H. A. Pilsbry, whom I had the pleasure of meeting in Philadelphia last year, on looking at my specimens, was much interested in this strange feature, and considered that it well justified the separation of the South Australian form from that found in the other States.

Owing to the imperfections of both figure and descriptions, it is necessary to append a full description. As far as I am aware, *Loricella angasi* has only been figured in Dr. Pilsbry's famous monograph on Polyplacophora, pl. 51, fig. 9, the drawings of which were made by Emerton, for Carpenter, Dr. Pilsbry having no specimens to examine. In that figure short hairs are shown on the anterior portion of the girdle, but Dr. Pilsbry appends a note, "The hairs shown in the girdle, in fig. 9, are foreign to it."

LORICELLA ANGASI, H. Adams and Angas.
(Proc. Zool. Soc., 1864, p. 193.)

General appearance.—Shell broad, carinated; when alive the whole of shell is usually covered with limy encrustations and growing algae; when these are cleaned off the lateral areas are seen to be strongly raised and covered with close wavy ribbing. The pleural areas, closely covered with longitudinal wavy riblets; girdle, broad, the anterior portion is double the width of the posterior and is crenulate at margin, but in adult specimens this crenulation in the anterior portion is produced in a number of flattened finger-like processes, up to 4 mm. in length, and extending beyond the margin of the girdle.

Colour.—The anterior valve and lateral areas are terra-cotta, with the exception of valve 2, in which the lateral area is the same colour as the pleural area; in the pleural and dorsal areas the lighter markings are dull white, tinged with olive, and the darker markings vary from brownish-olive to light-brownish-olive. The girdle, while for the most part olivaceous, the margins and various patches are rosaline-purple, but this may be due to a red alga. Inside of valves white.

Anterior valve.—Very large and broad, strongly convex in the middle, apex recurved, the whole valve covered with closely-packed wavy riblets. The posterior margin finely serrated. The inside has 8 slits nearly equidistant, teeth finely pectinated, and on the upper side fluted.

Posterior valve.—This is the smallest of the valves, the mucro terminal, and much elevated; the posterior half of this valve is recurved, diagonal ridges strongly raised, and the dorsal ridge well marked. The whole valve covered with wavy longitudinal ribbing, with transverse growth lines.

Central valves.—Lateral area strongly raised and sculptured with closely-packed wavy ridges similar to the anterior valve, broken at irregular intervals by deep sulci following

the growth lines; also in some of the valves the ribbing shows a subpustulose tendency; the posterior margin is finely serrated. Pleural area and dorsal area covered with closely-packed wavy longitudinal ribbing, which is decussated or bridged in the dorsal area and partly in the pleural area; eaves prominent; insertion plates fluted on upper side and very strongly toothed with sharp saw-like teeth; sutural laminae much produced; sinus broad and lobed.

Girdle.—In dried specimen 8 mm. wide in front, or without the flattened appendages, 5 mm. in front and half that width behind, cleft for half its width at tail, very closely beset with solid, irregular, minute scales. But the most marked feature is a large number of coarse, branching, brown hairs or spicules up to 4 mm. in length, placed in an irregular double row, spaced from 2 to 3 mm. apart in the anterior half, but hardly present in the posterior half. Each branch of these hairs has an ovate, spindle-shaped terminal, reminding one of a white stiletto, but they are too broad to be described by that term, and may be better described as sharply-pointed white cylinders or spear-heads, which are at their base twice the thickness of the hair to which they are attached. These strange white spicules are clustered thickly at the base of and along the centres of the flattened finger-like processes, before referred to; these are sessile, rising straight out of the girdle. There seems to be some relation between these spicules and the protruding portions of the girdle, as they and the hairs to which they are attached are only present opposite these. There are a few scattered about the girdle not in the main double row.

Measurements.—The specimen described in the foregoing is 67 × 41 mm. Another, taken at the same time, now in Mr. May's collection, measures 68 × 47 mm.; and one I found washed up on the beach at Aldinga Bay is 68 × 48 mm. When alive the girdle would add somewhat to the foregoing measurements.

Habitat.—I first took this shell alive at Marino in 1897, in a deep hole at lowest tide, and I believe no other was found at this locality until March 7, 1917, just twenty years later, when I found the two of which measurements are given above, both in the same hole, adhering to the upper side of a rock at lowest spring tide. All three were so densely covered with growth that they were most difficult to detect. I have twice found specimens washed ashore at Aldinga Bay, and Adams and Angas' type came from Rapid Bay, a little further down the gulf. Dr. Verco dredged a few specimens in the same gulf, so we may conclude that it is a fairly deep-water species.

Comparisons with other specimens.—I have one that I found washed up at Aldinga Bay, measuring 35 × 28 mm. dry,

in which all the valves except 2 and 8 are rosy-pink; valves 2 and 8 are greyish, and only tinged with pink; the girdle is rosy-pink, except where it is opposite valves 2 and 8, where it is blotched grey and white. The characteristic spicules, before described, are present in all my South Australian specimens. The sculpture in the smaller one is subpustulose in some of the ridges, especially the anterior margin of the lateral areas; the posterior margin is more strongly toothed than is the case with the larger specimens. Dr. Torr has several of the smaller size that show the same pustulose character in the sculpture. A specimen 30 mm. in length, dredged in St. Vincent Gulf, exhibits the same "spear-headed" hairs, and a small one, 23 mm. long, preserved in spirit, collected at Aldinga Bay, has the girdle well clothed with hairs terminating in similar "spear-head" spicules.

Remarks.—All specimens examined, collected by Dr. Torr, Dr. Verco, and myself, show the "spear-headed" spicules, and none of those examined from the other States exhibit this character.

LORICELLA TORRI, n. sp.

Differs from *Loricella angasi*, H. Adams and Angas, in that the white, "spear-headed" spicules on the girdle, and attached to the coarse hairs in that species, are absent in this.

The coarse hairs on the girdle are branching, and are, where perfect, transparent at their apices, but the transparent portions are the same width as the hairs and evidently the growing points thereof, and are very different from the broad, "spear-head" processes of *Loricella angasi*. The Sydney shell shows more raised and stronger ribbing. The anterior valve has 8 or 9 distinct rays, or coarse ribs, in addition to the closely-packed wavy ribbing. In one specimen in my collection from Sydney Harbour, the closely-packed wavy ribbing is almost absent, and in this one the ray ribs on the anterior valve, and the anterior and posterior margins of the lateral areas, consist of rows of elevated pustules. I think it possible that this character is more or less common to all juvenile specimens from New South Wales, and that with age these prominent tubercles are either eroded or absorbed. All the specimens that have come under my notice are more olivaceous than the South Australian shell.

Habitat.—The type I collected in shallow water at low tide at the Quarantine Station, Sydney, New South Wales, in November, 1918. I am presenting same to the South Australian Museum. It appears fairly common at Port Jackson, and frequents much shallower water than is the case with the South Australian species. I actually found one on a large rock several feet above low-water mark. I have one

dredged by Mr. Gabriel in 5 fathoms, at Western Port, Victoria, measuring 33 × 22 mm., in which the ray ribbing of anterior valve is well defined, but the closely-packed intermediate ribbing is hardly discernible, except near the margin; one of the coarse hairs on this specmen is 9 mm. long. Dr. W. G. Torr kindly showed me his Victorian specimens, which are similar to mine.

Tasmanian form.—Both Mr. W. L. May (of Tasmania) and Dr. Torr have been good enough to lend me their Tasmanian shells for the purposes of this paper. Mr. May writes that it is rare at Port Arthur. These Port Arthur specimens show a considerable divergence from most of the New South Wales shells, and are approached most nearly by the dredged specimen, before referred to, from Western Port, Victoria. The largest shell from Port Arthur is in Mr. May's collection, and measures 41 × 31 mm., has practically no decussation on dorsal or pleural area, but the smaller shell shows it to some extent; the riblets on the anterior valve are not as strong and the tail valve is more elevated than the New South Wales type. But the small shell from Sydney, before referred to, diverges from the type quite as much in these respects. I therefore do not feel justified in separating the Tasmanian Port Arthur shell from the New South Wales and Victorian ones; they all show the coarse, branching hairs on the girdle, without the strange "spear-head" processes that are present in the South Australian species.

Remarks.—The sculpture in this species shows a good deal of variation. Speaking generally, the ribbing is coarser and more defined in the northern shells and less conspicuous in the Tasmanian. But these characteristics are hardly sufficiently persistent to justify the making of a subspecies. It is just possible that there may be two shells in New South Wales, in which case one might be justified in separating the Tasmanian form. If there are no intermediates the small shell I have referred to might well be a second New South Wales species.

In conclusion.—In none of these specimens from New South Wales, Victoria, and Tasmania are the flattened finger-like processes margining the girdle developed beyond the incipient stage, and it is quite possible that this character may be peculiar to the adult shells of the South Australian species, but without the examination of a much larger amount of material from the other States I hesitate to quote this character as one of the distinguishing ones of the South Australian shell.

The measurements given in this paper show that the adult South Australian shell is much larger, often double the size, of its congener.

I am suggesting the name of *torri* for this species, after my friend Dr. W. G. Torr, to whom I am indebted for a good deal of material I hope to deal with in a future paper.

Addendum.

Since writing the foregoing Dr. J. C. Verco has sent me his stereoscopic microscope, and with the aid of this splendid instrument the following additional observations have been made:—

The so-called scales, with which the girdle is clothed, are of a distinct and peculiar character. The statement by Carpenter, published by Dr. Pilsbry (Man. Con., pt. 56, p. 239), that they "resemble grains of wheat set on end," is a very good one; they are bilobed, and shaped like the blunt or broad end of a grain of wheat, patches of them being level, almost like a cobble pavement; other patches are irregular, many standing up for more than half the length of the "wheat-grain" above the normal level. These bilobed, grain-like scales are, most of them, transparent and glassy; others, again, are opaque and white, but still with a glass-like appearance.

Between these "wheat-grains" the strange "spear-heads" push through and look like a cylindrical pointed spear-head made of porcelain, and are, I estimate, eight times the length of the scales.

Later, as the "spear-head" is pushed forward, a pale-brown, horny-looking tube, or stalk, is produced, which is heretofore described as a coarse hair, for want of better term, which, as it lengthens, buds. First the porcelain "spear-head" is produced, behind which the horny tube-like stem widens by the addition of an extra flute, ultimately becoming a distinct branch. In one or two instances a single stalk has branched six times and been furnished with six "spear-heads." These side branches are of a considerable length, often several times the length of the spear-headed apex. I believe the branches do not again bifurcate, although they appear to do so, due to the fact that three or four of these stalks come through the same aperture in the girdle, usually side by side rather than in a circle, as do the spicules in Acanthochitons.

The tubes, or coarse hairs, are pale horn-colour, highly polished, as if varnished, transversely striated; in some cases the striae are near together, but more usually forming somewhat distant rings for the whole length of the tube. In a few instances these striae are absent; in others the sulcae are broader and placed at greater distances, suggestive of segments or the knodes of a plant.

The spear-heads vary a good deal, both in size and shape. Some are long and lanceolate, sharply pointed; others are globose and blunt; many are oblique, slightly scimitar-shaped; all are equally white and glossy.

As before stated, the longer hairs, or tubes, take their rise in clusters fairly equidistant midway across the girdle, and are placed opposite the strange finger-like processes, those nearest the shell measuring up to 4 mm. in length, but becoming shorter and shorter as the margin of the girdle is approached until along the centres of the finger-like processes they are nearly all unstalked, and form a closely-packed row of porcelainous spear-heads, some still partly buried in the girdle. Along the front of the finger-like processes the spear-heads are small and scattered, not adhering to the mid-line, as is the case further back.

To the question, What is the function of the strange coarse hairs, or tubes, and their peculiar apices, and what purpose do they serve? I can find no definite answer. I do not think their purpose is either that of decoration or protection, for in life the shell and girdle are covered with growth. Also, it is most strange that the allied form occuring in the other States should not have similar spear-headed terminals to the hairs; possibly they do have them at an early stage, and dispense with them in the adult form, though in the specimens examined there is nothing to suggest this.

One is struck with the points of similarity between the genus *Loricella* and the North American genus *Placiphorella*, belonging to the family Mopaliidae. Mr. S. Stillman Berry, in his valuable paper on "Chitons taken by the United States Fisheries steamer 'Albatross'" (U.S. Nat. Mus. Proc., vol. 54), figures several of this genus which exhibit the following similarities: The girdle is much wider in front than behind, the foot is short and broad, and for the size of the shell small; the girdle is adorned with remarkable hairs, although these are structurally very different, but in pl. 9, fig. 6, he shows the presence of some minute spicules that are somewhat similar, though much smaller, to the "spear-heads" on *Loricella angasi*.

I have presented the type of *Loricella torri* to the South Australian Museum.

DESCRIPTION OF PLATE X.

Fig. 1. Shell of *Loricella angasi*, Ad. and Ang., $\times\frac{7}{8}$, showing in girdle, slit, fringed margin, and spicules, p. 60.

,, 1*a*. Girdle of same, ×6, showing finger-like processes and spear-headed spicules.

,, 1*b*. Girdle and part shell of *Loricella torri*, n. sp., ×6, p. 62.

,, 1*c*. *Loricella angasi*, Ad. and Ang., ×2, underside showing animal.

,, 1*d*. Spear-headed spicules and girdle margin of same, ×20.